Progressive Education Society's

Modern College of Arts, Science & Commerce (Autonomous)

Ganeshkhind, Pune – 411016

NATIONAL EDUCATION POLICY - 2020 (NEP-2020)

Basic and Honors Degree Program in

Bachelor of Computer Applications (Science): B.C.A. (Science)

(Faculty of Science & Technology)

Syllabus for T.Y. B.C.A. (Science) 5th and 6th Semesters

To be implemented from Academic Year 2025-2026

Title of the Course: Bachelor of Computer Applications (Science)

Preamble of the syllabus

       The B.C.A. (Science) program is a combination of computer and applied courses from science stream. The computer related courses introduce techniques of programming, databases, web designing, system analysis, design tools and different computing environments. The applied courses include mathematics, statistics and electronics that provide theoretical and practical foundation for the learner.

Objectives

- To produce knowledgeable and skilled human resources that is employable in IT.
- To impart knowledge required for planning, designing and building Complex Application Software Systems as well as to provide support for automated systems or applications.
- It helps students analyze the requirements for system development and exposes students to business software and information systems.
- This course provides students with options to specialize in legacy application software, system software or mobile applications.
- To produce entrepreneurs

Introduction

       The Structure of three or four Year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minor as per their choices and feasibility of exploring learning in different institutions.

       This Undergraduate Degree Program has been designed with a semester approach in mind. The First-year courses are aimed at skills development in computers using various technologies while the second year is more focused on core courses providing conceptual frame work. The third year provides the specialization and the project work and fourth year focused on initiate research binge at start-ups level.

       Students will be awarded certificate in computer application after one-year completion, diploma in computer application after two years of completion, get B.C.A. degree after three years' completion and B.C.A. (honors) degree after completion of four years. A four-year degree (Eight - semesters) in Computer Applications will get skills and information not only

about Computer and Information Technology but also in communication, organization, research and management with multidisciplinary approach.

Eligibility for Admission:

Any candidate who has passed the XII standard Examination in Science stream from, Maharashtra State Board of Secondary and Higher Secondary Education or equivalent Board of Examination, is eligible for admission to the First Year of this program.

Course Code	Course Type	Course Title	Credits		Evaluation		
			TH	**PR**	**CIA**	**CSE**	**Total**
BCA35101	Major	Operating System	4	-	40	60	100
BCA35102	Major	Advanced Java	2	-	20	30	50
BCA35103	Major	Operating System Laboratory	-	2	20	30	50
BCA35104	Major	Advanced Java Laboratory	-	2	20	30	50
BCA35105	Elective	React JS	2	-	20	30	50
BCA35106	Elective	React JS Laboratory	-	2	20	30	50
OR (Choose any one Elective [T + P])							
BCA35107	Elective	Object Oriented Software Engineering	2	-	20	30	50
BCA35108	Elective	Object Oriented Software Engineering Laboratory	-	2	20	30	50
BCA35210	Minor	Data mining	2	-	20	30	50
BCA35211	Minor	Data Mining Laboratory	-	2	20	30	50
BCA35409	VSC	Internet of Things (IoT) Laboratory	-	2	20	30	50
BCA35613	FP	Field Project	-	2	20	30	50
Total			**10**	**12**	**220**	**330**	**550**
Total Credits: [10 (TH) + 12 (PR)] = 22							
TH: Theory **PR:** Practical **CIA:** Continuous Internal Assessment **CSE:** College Semester Examination							

Semester -V T.Y. B.C.A (Science)

Course Code	Course Type	Course Title	Credits		Evaluation		
			TH	PR	CIA	CSE	Total
BCA36101	Major	Android Programming	4	-	40	60	100
BCA36102	Major	Advanced Web Technology	2	-	20	30	50
BCA36103	Major	Android Programming Laboratory	-	2	20	30	50
BCA36104	Major	Advanced Web Technology Laboratory	-	2	20	30	50
BCA36105	Elective	Node JS	2	-	20	30	50
BCA36106	Elective	Node JS Laboratory	-	2	20	30	50
OR (Choose any one Elective [T + P])							
BCA36107	Elective	Software Testing	2	-	20	30	50
BCA36108	Elective	Software Testing Laboratory	-	2	20	30	50
OR (Choose any one Elective [T + P])							
BCA36109	Elective	Cloud Computing	2	-	20	30	50
BCA36110	Elective	Cloud Computing Laboratory	-	2	20	30	50
BCA36211	Minor	Machine Learning	2	-	20	30	50
BCA36212	Minor	Machine Learning Laboratory	-	2	20	30	50
BCA36613	OJT	OJT	-	4	40	60	100
Total			**10**	**12**	**220**	**330**	**550**
Total Credits: [10 (TH) + 12 (PR)] = 22							
TH: Theory **PR:** Practical **CIA:** Continuous Internal Assessment **CSE:** College Semester Examination							

Semester -VI T.Y. B.C.A (Science)

T.Y. B.C.A. SEMESTER V	
Subject Code:BCA35101	**Subject Name: Operating System**
Credits: 04 **Theory: 04 Hrs./Week**	**Continuous Internal Assessment: 40 Marks** **College Semester Examination: 60 Marks**

Course Objectives:

- To study algorithms for CPU-scheduling, Process Creation and Termination.
- To understand the notion of a Multithreading and Inter-Process Communication.
- To learn Critical-Section problems and Classical Process-Synchronization problems.
- To know the Deadlock Concept, different methods for Preventing or Avoiding Deadlocks and techniques for Memory Management.
- To learn and understand File System, Directory Structure, File Allocation Methods and Disk Scheduling Algorithms.

Course Outcomes:

On completion of the course, student will be able to–

- Describe algorithms for Process, Memory and Disk Scheduling
- Apply technique for Inter-Process Communication and Multithreading.
- Implement concept of Critical-Section
- Compare and contrast Deadlock Avoidance and Prevention.
- Use functions for File System Management

Course Contents	
Unit I Process Scheduling and Multithreaded Programming	**14Hrs**
Process Scheduling – Scheduling queues, Schedulers, Context switch, Operations on Process – Process creation with program using fork(), Process termination, Inter-process Communication – Shared memory system, Message passing systems, Multithreaded Programming – Overview Basic Concept – CPU-I/O burst cycle, CPU Scheduler, Pre-emptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round- robin scheduling, Thread Scheduling- Threads, benefits, Thread Libraries	
Unit II Process Synchronization	**08 Hrs**
Background, Critical Section Problem, Semaphores Classic Problems of Synchronization – The bounded buffer problem, the reader, writer problem, the	

dining philosopher problem.	
Unit III Deadlock	**10 Hrs**
System Model, Deadlock Characterization – Necessary Conditions, Resource Allocation Graph Deadlock Prevention, Deadlock Avoidance - Safe state, Resource-Allocation-Graph Algorithm, Banker's, Algorithm, Deadlock Detection, Recovery from Deadlock – Process Termination, Resource Pre-emption	
Unit IV Memory Management	**12 Hrs**
Background – Basic, Logical Versus Physical, Address Space, Dynamic Loading, Dynamic Linking and Shared Libraries, Overlays, Swapping, Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation Paging – Basic Method, Hardware support, Protection, Shared Pages, Segmentation – Basic concept, Virtual Memory Management – Demand paging, Performance of demand paging, Page replacement – FIFO, Optimal, LRU	
Unit V File System	**10 Hrs**
File Concept, File Attribute, File Operations, File Types, File Structure, Access Methods - Sequential Access Method, Direct Access Method, Other Access, Methods, Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory, File System Structure and Implementation - Partitions and Mounting, Virtual, File Systems, Allocation Methods - Contiguous allocation, Linked allocation, Indexed allocation	
Unit VI Disk Scheduling	**06 Hrs**
System Model, Deadlock Characterization – Necessary Conditions, Resource Allocation Graph Overview, Disk Structure, Disk Scheduling, FCFS Scheduling, SSTF Scheduling	

Reference Books:
1) Operating System Concepts, Avi Silberschatz, Peter Galvin, Greg Gagne, 8th Edition, Wiley Asia
2) Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall of India

3) Modern Operating Systems 4th Edition, by Andrew Tanenbaum, Herbert Bos

4) Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI

5) Advanced Concepts in Operating Systems, Mukesh Singhal and

   Niranjan G Shivaratri, Tata McGraw Hill Inc, 2001

T.Y. B.C.A. SEMESTER V	
Subject Code:BCA35102	**Subject Name: Advanced Java**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To understand collection classes and interfaces.
- To know the process of application development using Graphical User Interface (GUI).
- To acquire knowledge about handling databases using Java.
- To study web components for developing web applications.

Course Outcomes:

On completion of the course, student will be able to–

- Design end to end applications using object oriented constructs.
- Apply collection classes for storing java objects.
- Use Java APIs for program development.
- Handle abnormal termination of a program using exception handling.

Course Contents	
Unit-I Collection	**05 Hrs**
Introducing to Collections framework, List - ArrayList, LinkedList, Set - HashSet, TreeSet, Map - HashMap and TreeMap, Interfaces such as Comparator, Iterator, ListIterator, Enumeration, Exception handling- try ,catch ,finally, throw and throws,Inputs Outputs.	
Unit-II Multithreading	**05 Hrs**
Threads and Life cycle of thread, Creating threads - Thread class , Runnable interface, Thread priorities, Running multiple threads, Synchronization and interthread communication, Thread Methods, Thread Scheduler, ThreadGroupclass	
Unit-III Database Programming	**05 Hrs**
The role of jdbc, jdbc configuration, Types of drivers, Connectivity with database, JDBC Statements – Statement, Prepared Statement, Callable Statement, Scrollable and updatable result sets, Metadata – DatabaseMetadata, ResultSetMetadata (Database: PostgreSQL)	

Unit-IV Servlets	**05 Hrs**
Servlets: Introduction to Servlets and Hierarchy of Servlets, Life cycle of a servlet, Tomcat configuration (Note: Only for Lab Demonstration), Handing get and post request (HTTP), Handling a data from HTML to a servlet, Session tracking – Cookies and Http Session	
Unit-V JSP	**05 Hrs**
JSP: Simple JSP program, Life cycle of a JSP, Implicit Objects, Scripting elements – Declarations, Expressions, Scriplets, Comments, JSP Directives – Page Directive, include directive, Mixing Scriplets and HTML	
Unit-VI Spring Framework	**05 Hrs**
Introduction of spring framework, Spring Modules / Architecture, Spring Applications, Spring MVC, Spring MVC Forms, Validation	

Reference Books:

1) Core Java Volume I - Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-0-13-516630-7

2) The Complete Reference By Herbert Shildt, 11th Edition, McGraw Hill Education, ISBN 978-260-44023-2

3) Java Beginners Guide By Herbert Shildt, 8th Edition, McGraw-Hill Education ISBN 978-1- 260-44021-8

4) Core Java Volume II – Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall, ISBN 978-013-516631-4

5) Java 2 Programming Black Book By Steven Holzner, DreamTech Press, ISBN 978-93-5119-953-4

T.Y. B.C.A. SEMESTER V	
Subject Code: BCA35103	**Subject Name: Operating System Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To study algorithms for CPU-scheduling, Process Creation and Termination.
- To study the process management and scheduling.
- To Study Memory Management.
- To study and understand searching techniques

Course Outcomes:

On completion of the course, student will be able to–

- Describe algorithms for Process, Memory and Disk Scheduling
  Implement algorithms for Process scheduling and Memory
  management.
- Describe process synchronization and multithreading
- Compare and contrast the algorithms for memory management and its allocation policies.
- Use searching algorithms, Design a simple Expert system
- Understand the informed and uninformed problem types and apply search strategies to solve them.

Lab Course Contents	
Sr. No	**Assignment**
1	Operations on processes
2	CPU Scheduling
3	Deadlock detection and avoidance
4	Page Replacement Algorithms
5	File System
6	Disk Scheduling Algorithms

T.Y. B.C.A. SEMESTER V	
Subject Code: BCA35104	**Subject Name: Advanced Java Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To understand collection classes and interfaces.
- To know the process of application development using Graphical User Interface (GUI).
- To acquire knowledge about handling databases using Java.
- To study web components for developing web applications.

Course Outcomes:

On completion of the course, student will be able to–

- Design end to end applications using object oriented constructs.
- Apply collection classes for storing java objects.
- Use Java APIs for program development.
- Handle abnormal termination of a program using exception handling.

Lab Course Contents	
Sr. No	**Assignment**
1	Collection
2	Multithreading
3	Database Programming
4	Servlet
5	JSP
6	Spring Framework

T.Y. B.C.A. SEMESTER V	
Subject Code:BCA35105	**Subject Name: React JS**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To understand React.
- To know the process of application development using React Components.
- To acquire knowledge about Navigation and State management using React.
- To study web components for developing web applications using APIs.

Course Outcomes:

On completion of the course, student will be able to–

- Design end to end web pages using React.
- Apply collection of different components of React.
- Use APIs for program development.
- Handle Themes and Styles.

Course Contents	
Unit-I Introduction to React Native	**05 Hrs**
Overview of React and its benefits, Setting up a development environment, Understanding JSX syntax, Creating and rendering React components, Introduction to React hooks (useState, useEffect)	
Unit-II Core Components	**05 Hrs**
Understanding the concept of components, Props and state management in React, Functional components vs. class components, Creating reusable components, Component lifecycle methods	
Unit-III Advanced Components	**05 Hrs**
Event handling in React, Forms and controlled components, Handling user input with forms, Form validation techniques	
Unit-IV Navigation and State Management	**05 Hrs**
Introduction to React Router, Setting up routes in a React application, Creating nested routes,Implementing route parameters and query strings,Using NavLink and Redirect components	
Unit-V APIs and Data Storage	**05 Hrs**
Introduction to Redux and its principles, Setting up Redux in a React application, Actions, reducers, and the store, Connecting React components to Redux, Asynchronous actions with Redux Thunk	
Unit-VI Styling and Theming	**05 Hrs**
Understanding React hooks in depth, useState, useEffect, useContext, and more Custom hooks and their usage, Best practices for using hooks	

T.Y. B.C.A. SEMESTER V	
Subject Code: BCA35106	**Subject Name: React JS Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To understand React App.
- To know the process of application development using different React Components
- To acquire knowledge about handling Events using React.
- To study routers, redux, hooks for developing web applications.

Course Outcomes:

On completion of the course, student will be able to–

- Design end to end applications using React.
- Apply collection of React components.
- Use APIs for program development.
- Handle routers, redux, hooks.

Lab Course Contents	
Sr. No	**Assignment**
1	Practical on creation of first react app and running
2	Practical on use of core components and imports
3	Creating forms and their events in react app
4	Using routers in app
5	Using redux in app
6	Using hooks in app

T.Y. B.C.A. SEMESTER V	
Subject Code:BCA35107	**Subject Name: Object Oriented Software Engineering**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
- To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
- To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.

Course Outcomes:

On completion of the course, student will be able to–

- Have an ability to apply software testing knowledge and engineering methods.
- Have an ability to design and conduct a software test process for a software testing project.
- Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.
- Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.

Course Contents	
Unit - I: Introduction to Software Engineering	**03 Hrs**
Definition of Software , Characteristics of Software , Software Application Domain ,Definition of Software Engineering , Program vs. Software, Need for software Engineering, Characteristics of software	

Unit - II Object Oriented Software Engineering	**03 Hrs**
Introduction to object orientation- Classes and objects, Messages, Attributes and Methods, Encapsulation, Inheritance, Polymorphism, Object Oriented Methodology- Coad and Yourdon Methodology, Object Oriented Modeling	
Unit – III: Software Development Life Cycle (SDLC)	**06 Hrs**
Conventional Software Life Cycle Methods-Build-and-fix model,Waterfall Model, Prototyping Model, Iterative Enhancement Model, Spiral Model,Object Oriented Software Life Cycle Models, Fountain Model, Rational Unified Process	
Unit – IV: Software Requirement Elicitations and Analysis	**06 Hrs**
Software Requirement- Identification of Stakeholders, Functional and Non-functional requirements, Known and Unknown requirement, Requirements Elicitation Techniques- Interviews, Brainstorming Sessions, Facilitated Application Techniques, Prototyping, Software Requirements Specification (SRS) Documents- Nature of the SRS documents, Organization of the SRS Documents	
Unit – V: Analysis and Design Engineering	**06 Hrs**
Decision Tree and Decision Table , Data Flow Diagrams (DFD) , Data Dictionary , Elements of DD ,Advantages of DD , Input and Output Design, PseudoCode, Case Studies on above topics	
Unit – VI: Software Testing Strategies and Techniques	**06 Hrs**
Software Quality, Software Testing, Testing Objectives, Principles of Testing, Verification and Validation, Testing Techniques,Strategic-Black and White, Approach for Software Testing, Unit Testing, Integration Testing , System Testing , Alpha and Beta Testing, Agile Testing	

T.Y. B.C.A. SEMESTER V
Subject Code: BCA35108
Subject Name: Object Oriented Software Engineering Laboratory

Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development

Course Outcomes:

On completion of the course, student will be able to–

- Ability to translate end-user requirements into system and software requirements

- Ability to generate a high-level design of the system from the software requirements

- Will have experience and/or awareness of testing problems and will be able to develop a SRS report.

  Guideline :

- Students have to do all assignments on the basis of mini project.

Lab Course Contents	
Sr. No	**Assignment**
1	Mini Project Module I
2	Assignments on UML diagrams
3	Assignments on Test Cases and Test Plan and Test Strategies
4	Assignments of Test Methodologies
5	Assignments on Defect Managements.
6	Assignments on Automation Testing using Selenium.

T.Y. B.C.A. SEMESTER V	
Subject Code: BCA35409 **Subject Name: Internet of Things(IoT) Laboratory**	
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To understand basic building blocks of Internet of Things (IoT) and Embedded Systems hardware
- To know methodologies for IoT application development
- To implement the IoT protocols, cloud platforms in IoT
- To learn real world application scenarios of IoT along with its societal and economic impact

Course Outcomes:

On completion of the course, student will be able to–

- Identifying suitable hardware components of Embedded Systems and the Internet of Things
- Devlop software as per requirement of IoT application
- Select suitable communication protocols for communication among IoT devices
- Select suitable cloud-based IoT storage and comprehend security issues in IoT applications

Lab Course Contents	
Sr. No	**Assignment**
1	To Study Raspberry Pi / Arduino Architecture and Basic Programming
2	Interfacing of LED/Buzzer/Push button with Arduino/Raspberry Pi. and write a program to turn ON LED when push button is pressed or at sensor detection and write a program to turn ON LED when push button is pressed or at sensor detection
3	Interfacing Raspberry-Pi/ Adriano with IR sensor/Camera sensor
4	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity reading
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth
6	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud

T.Y. B.C.A. SEMESTER V	
Subject Code: BCA 35210	**Subject Name: Data Mining**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To introduce students to the basic concepts and techniques of Data Mining
- To study data mining algorithms for solving practical problems.
- To understand applications and trends in data mining

Course Outcomes:

On completion of the course, student will be able to–

- Define fundamental concepts of data mining.
- Demonstrates various preprocessing techniques.
- Implement various algorithms to analyze data sets.
- Understand requirements and methods for cluster analysis.
- Evaluate ethical considerations and emerging trends in data mining applications.

Course Contents	
Unit I Introduction to Data Mining	**06 Hrs**
Definition Data mining , Data Mining issues , Stages of the Data Mining Process (KDD) , Data Mining Techniques/Tasks , Knowledge Representation Methods , Applications of Data mining.	
Unit II Data Pre-processing and Warehousing	**06 Hrs**
Data Pre-processing: Data Cleaning, Data Transformation, Data Reduction Data Discretization, Data Warehousing: Introduction, Architecture and its components, Data Modeling with OLAP: Introduction, Difference between OLTP and OLAP, Schema Design: star Schema	
Unit III Data Classification	**06 Hrs**
Introduction, Definition, Decision Tree: Introduction , Construction Principle , Attribute Selection Measures , Tree Pruning, Rule-Based Classification: Using IF-THEN Rules for Classification, Rule Extraction from a Decision Tree, Naïve Bayes Classifier, K-Nearest Neighbor (KNN)	
Unit IV Clustering	**06 Hrs**

Cluster Analysis: Introduction, Requirements for Cluster Analysis, Hierarchical Method: Agglomerative Hierarchical Clustering, Divisive Hierarchical Clustering, Partitioning Methods: k-Means A Centroid-Based Technique, k-Medoids A Representative Object-Based Technique.	
Unit V Association Rule Mining	**05 Hrs**
Introduction to Association Rule Mining , Market Basket Analysis, Items, Itemsets and Large Itemsets , Apriori Algorithm , Kinds of Association Rules , Mining Multilevel association rules, Constraint Based Association rules mining	
Unit 6: Applications and Trends in Data Mining	**04 Hrs**
Text Mining and Sentiment Analysis, Web Mining: Web Content, Structure, and Usage Mining, Data Mining for Social Media Analytics, Ethical Issues in Data Mining, Future Trends in Data Mining	
Reference Books: Reference Books: 1)Data Mining : Introductory and Advanced Topics by Margaret Dunham, S. Sridhar, Pearson Publication 2) Data Mining concepts and Techniques by Jiawei Han and Micheline Kamber, ELSEVIER Third Edition, 3) R and Data Mining, By Yanchang Zhao, Elsevier Inc., ISBN-10: 0123969638 4) Data Science from Scratch: First Principles with Python By O‟Reilly Media, 20153. 5) Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining by Glenn J. Myatt John Wiley Publishers, 2007	

T.Y. B.C.A. SEMESTER V	
Subject Code:BCA35211	**Subject Name: Data Mining Laboratory**
Credits: 02 **Practical: 04 Hrs./Week**	**Continuous Internal Assessment: 20 Marks** **College Semester Examination: 30 Marks**

Course Objectives:

- To provide hands-on experience with essential data mining techniques and tools, enabling students to extract meaningful patterns, perform predictive analysis, and implement advanced algorithms for data classification, clustering, association, and pre-processing.

Course Outcomes:

On completion of the course, student will be able to–

- Apply data preprocessing techniques to clean and prepare data for mining processes.
- Implement classification methods such as Naïve Bayes Classifier to solve real-world problems.
- Perform regression analysis and identify outliers for improved data insights.
- Utilize clustering techniques, including K-Means and hierarchical methods, to group data effectively.
- Generate association rules using the Apriori algorithm to discover relationships among data attributes.
- Explore various tools for executing various data mining tasks.

Lab Course Contents	
Sr. No	**Assignments**
1	Data Preprocessing
2	Classification Techniques: Naïve Bayes Classifier
3	Regression Analysis and Outlier detection
4	Clustering: K-Means,Hierarchical
5	Association Rules: Perform ARM using Apriori Algorithm
6	Introduction to WEKA (Case Study)

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36101	**Subject Name: Android Programming**
Credits: 04 **Theory: 04 Hrs./Week**	**Continuous Internal Assessment: 40 Marks** **College Semester Examination: 60 Marks**

Course Objectives:

- To understand the Android Operating System
- To study Android Apps Development Cycle
- To learn to create Android Applications.

Course Outcomes:

On completion of the course, student will be able to–

- Describe the process of developing mobile applications.
- Create mobile applications on the Android Platform.
- Design and implement mobile applications involving data storage in SQLite database.
- Use location-based services while developing applications

Course Contents	
Unit I Introduction to Android	**9 Hrs**
Overview, History and Features of Android Architecture of Android: Overview of Stack, Linux Kernel, Native Libraries, Android Runtime, Application Framework, Applications SDK Overview: Platforms, Tools – (JDK, SDK, Eclipse/Android Studio, ADT, AVD, Android Emulator), Versions, Creating your first Android Application	
Unit II Activities, Fragments and Intents	**10 Hrs**
Introduction to Activities, Activity Lifecycle, Introduction to Intents, Linking Activities using Intents, Calling built-in applications using Intents, Introduction to Fragments, Adding Fragments Dynamically, Lifecycle of Fragment, Toast	
Unit III Android User Interface	**10 Hrs**
Understanding the components of a screen: Views and View Groups, Linear Layout, Absolute Layout, Table Layout, Relative Layout, Frame Layout, Scroll Layout, Scroll View, Constraint Layout, Adapting to Display	

Orientation: Anchoring Views, Resizing and Repositioning Split Screen / Multi-Screen Activities	
Unit IV Android Application Structure	**10 Hrs**
Android basic building blocks: Services, Broadcast Receivers & Content providers, UI Components -view and notifications, Components for communication - Android API levels (versions & version names) AndroidManifest.xml, Uses-permission , Dalvik Virtual Machine & .apk file extension, Resources & R.java, Assets, Drawable Resources, First sample Application.	
Unit V Designing Your User Interface with Views	**12 Hrs**
Using Basic Views: TextView, Button, ImageButton, EditText, CheckBox, Switch, ToggleButton, RadioButton, and RadioGroup Views, ProgressBar View, AutoCompleteTextView View Using Picker Views:,TimePicker View and DatePicker View Using List Views to Display Long Lists:,ListView View, Using the Spinner View Understanding Specialized Fragments : Using a ListFragment,Using a DialogFragment Displaying Pictures and Menus: Using Image Views to Display Pictures, Gallery and ImageView views, Image Switcher, Grid View, Using Menus with Views, Creating the helper methods, Options Menu, Context Menu, VideoView: Play video from URL with using VideoView, VideoView Create, Optimized VideoView, Optimized VideoView in ListView	
Unit VI SQLite , Messaging and Email	**09 Hrs**
Introduction to SQLite, SQLite Open Helper and SQLite Database Creating, opening and closing database, working with cursors, Insert, Update, Delete Building and executing queries, SMS Messaging: Sending SMS Messages Programmatically, Getting Feedback after Sending a Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Caveats and Warnings, Sending E-mail	
Reference Books: 1) Beginning Android4 Application Development, By Wei-Meng Lee WILEY India Edition WROX Publication 2) Professional Android 4 Application Development, By Reto Meier WROX Publication 3) Head First Android Development: A Brain-Friendly Guide, By David Griffiths and Dawn	

Griffiths

Websites:

1) The official site for Android developers - https://developer.android.com

2) https://www.tutorialspoint.com/android/index.htm

3) https://www.javatpoint.com/android-tutorial

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36102	**Subject Name: Advanced Web Technology**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To Learn different technologies used at client Side Scripting Language
- To Learn XML and XML parsers.
- To One PHP framework for effective design of web application.
- To Learn Java Script to program the behavior of web pages.
- To Learn AJAX to make our application more dynamic.

Course Outcomes:

On completion of the course, student will be able to -

- Build dynamic website.
- Using MVC based framework easy to design and handling the errors in dynamic website

Course Contents	
Introduction to PHP	**03 Hrs**
Introduction to php, How to install PHP Server on LINUX, WINDOWS, Syntax, Echo, print,Variables, Data Types , Strings , Operators , Loops.	
PHP Functions and Arrays	**06 Hrs**
Introduction to Functions (Defining and Calling Functions, Default parameters, Variable parameters, Missing parameters), Types of PHP Functions (Anonymous Function, Variable Function). Indexed Vs Associative arrays, Identifying elements of an array, Storing data in arrays, Multidimensional arrays, Extracting multiple values, Converting between arrays and variables	
Introduction to Object Oriented Programming in PHP & Web Techniques	**05 Hrs**
Classes, Objects, Encapsulation, Constructor and Destructor, Inheritance, Interfaces, Introspection, Super global Variables, Server information, Sticky forms, File Uploads, Setting response headers, Maintaining state, Session and Cookies	
Files and Directories & DataBase	**07 Hrs**
Working with files and directories, Opening and Closing, Getting information about file, Reading and writing characters in file, Rename and delete files,	

Random access to file data, Getting information on file, Ownership and permissions, Using PHP to access/insert/update/delete a database tables, Relational databases and SQL, Introduction to PEAR DB basics (No assignments), Advanced database techniques, Simple applications	
XML & Ajax	**07 Hrs**
What is XML? ,XML document Structure, PHP and XML, XML parser, The document object model, The simple XML extension, Changing a value with simple XML, Understanding java scripts for AJAX, AJAX web application model, AJAX –PHP framework, Performing AJAX validation, Handling XML data using php and AJAX, Connecting database using php and AJAX	
Introduction to Web Services	**02 Hrs**
SOAP, WSDL, Application of web services	

Reference Books:

1. Complete HTML- Thomas Powell

2. HTML and JavaScript–Ivan Bayross

3. Programming PHP By Rasmus Lerdorfand Kevin Tatroe, O'Reilly publication

4. Beginning PHP

5, Wrox publication 5. PHP for Beginners, SPD publication

e‑Books :

1. https://www.w3schools.com

2. https://wwwtutorialspoint.com

3. https://www.php.net

4. Thinking in HTML eBook by Aravind Shenoy

5. Learn HTML and CSS faster by Mark Myers

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36103	**Subject Name: Android Programming Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To understand the Android Operating System
- To study Android Apps Development Cycle
- To learn to create Android Applications

Course Outcomes:

On completion of the course, student will be able to–

- Describe the process of developing mobile applications.
- Create mobile applications on the Android Platform.
- Design and implement mobile applications involving data storage in SQLite database.
- Use location-based services while developing applications

Lab Course Contents	
Sr. No	**Assignment**
1	Introduction to Android
2	Activities, Fragments and Intents
3	Android User Interface
4	Designing User Interface with Views
5	Databases-SQLite, Messaging and E-mail

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36104	**Subject Name: Advanced Web Technology Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To Design dynamic and interactive Web pages.

- To Learn Core-PHP, Server Side Scripting Language

- To Learn PHP- Database handling

- To apply statistical, data preprocessing and visualization techniques on data sets

Course Outcomes:

On completion of the course, student will be able to–

- Understand how to develop dynamic and interactive Web Page

- Prepare data for use with a variety of statistical methods and recognize how the quality of the data may affect conclusions.

- Perform exploratory data analysis

Lab Course Contents

Sr. No	Lab Assignment
1	Assignment on PHP
2	Assignment on PHP Functions and Arrays
3	Assignment on PHP File Upload and Download
4	Assignment on PHP File Access and Database Handling
5	Assignment on XML
6	Assignment on Ajax

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36105	**Subject Name: Node JS**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To Learn different web models in Node Js
- To Learn web server creation.
- To Learn Debugging of Node Js app.
- To Learn Express Js and static resources.

Course Outcomes:

On completion of the course, student will be able to–

- Describe the process of developing Node Js application.
- Create Node Js Modules.
- Design and implement web Server.
- Use Express Js and Static Resources.

Course Contents	
Unit I Introduction to Node JS	**05 Hrs**
Introduction to Node JS , What is Node JS, Node.js Process Model , Advantages of Node JS, Traditional Web Server Model ,Setup Development Environment, Install Node.js on Windows ,Working in REPL, Node JS Console	
Unit II Node JS Modules	**05 Hrs**
Functions, Buffer, Module , Core Modules, Local Modules, Modules Types, Modules Exports ,Node Package Manager, What is NPM, Installing Packages Locally, Adding dependency in package json ,Installing package globally , Updating packages Session	
Unit III Creating Web Server	**05 Hrs**
Creating Web Server, Handling http requests , Sending Requests ,File System, Fs.readFile, Writing a File, Writing a file asynchronously, Opening a file, Deleting a file, Other IO Operations	
Unit IV Debugging Node JS Application	**05 Hrs**
Debugging Node JS Application, Core Node JS Debugger ,Events, Event Emitter class, Returning event emitter, Inheriting Events	
Unit V Express JS	**05 Hrs**
Express JS,Configuring Routes, Working with Express	
Unit VI Serving Static Resources	**05 Hrs**
Serving Static Files, Working with Middle Ware , Database Connectivity , Connecting String, Configuring, Working with Select Command, Updating Records, Deleting Records	

Reference Books:

1. Node.js Design Patterns - Third edition. ...

2. Beginning Node.js, Express & MongoDB Development. ...

3. Distributed Systems with Node. ...

4. Ultimate Node.js for Cross-Platform App Development: Learn to Build Robust, Scalable, and Performant Server-Side JavaScript Applications with Node.js. ...

5. Node.js Cookbook - Fifth Edition. ...

6. Mastering Node.

Websites :

1 GUI
2 nodejs.org
3 Codecademy
4 freeCodeCamp
5 The Odin Project
6 MDN Web Docs
7 Udemy
8 Coursera
9 Frontend Masters
10 egghead.io

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36106	**Subject Name: Node JS Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To Design Node Js Pages.
- To Learn Core-Node Js
- To Learn File handling
- To apply Express Js on Database Handling

Course Outcomes:

On completion of the course, student will be able to–

- Understand how to develop dynamic and interactive Web Page
- Prepare Pages for handling files.
- Perform use of Express Js for Database handling

Lab Course Contents	
Sr. No	**Assignment**
1	Practical on Setup Development Environment
2	Use of Function, Modules and Packages
3	Handling Files
4	Use of Express Js
5	Database Handling

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36107	**Subject Name: Software Testing**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

• To provide the knowledge of software testing techniques

• To understand how testing methods can be used as an effective tools in quality assurance of software.

• To provide skills to design test case plan for testing software.

• To provide knowledge of latest testing methods

Course Outcomes:

• To understand various software testing methods and strategies.

• To understand a variety of software metrics, and identify defects and managing those defects for improvement in quality for given software.

• To design test cases and test plans, review reports of testing for qualitative software.

• To understand latest testing methods used in the software industries

Course Contents	
Unit I Introduction to Software Testing	
Basics of Software -Testing faults, errors and failures, Testing objectives Principles of testing, Testing and debugging Testing metrics and measurements Verification and Validation Testing Life Cycle	**05 Hrs**
Unit II Types of Testing	
Testability - Characteristics lead to testable software. Test characteristics Test Case Design for Desktop, Mobile, Web application using Excel White Box Testing - Basis path testing, Control Structure Testing. Black Box Testing- Boundary Value Analysis, Equivalence partitioning. Differences between BBT & WBT	**08 Hrs**
Unit III Testing Strategies	
A Strategic Approach to Software Testing Test strategies for conventional Software Unit testing Integration testing – Top-Down, Bottom-up integration System Testing – Acceptance, performance, regression, Load/Stress testing, Security testing, Internationalization testing. Alpha, Beta Testing Usability and accessibility testing Configuration, compatibility testing	**08 Hrs**
Unit IV Dimension of Quality	

Dimension of Quality, Error within a WebApp Environment Testing Strategy for WebApp Test Planning The Testing Process –an overview	**04 Hrs**
Unit VAgile Testing	
Agile Testing, Difference between Traditional and Agile testing, Agile principles and values, Agile Testing Quadrants, Automated Tests	**05 Hrs**
Reference Books: 1. Software Engineering – A Practitioners Approach, Roger S. Pressman, 7 thEdition, Tata McGraw Hill, 20 2. Effective Methods of Software Testing, William E Perry, 3rd Edition, Wiley Publishing Inc 3. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, Microsoft Press, 1999 4. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin and Janet Gregory, 1 st Edition, Addison-Wesley Professional, 2008 5. Software Testing Principles and Practices By Srinivasan Desikan, Gopalaswamy	

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36108	**Subject Name: Software Testing Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:

- To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.

Course Outcomes:
On completion of the course, student will be able to–

- Ability to test software using Test Cases.
- Ability to generate test methodology.
- Will have experience and/or awareness of testing problems and will be able to develop test cases on Selenium.

Guideline :

- Students have to do all assignments on the basis of project.

Lab Course Contents	
Sr. No	**Assignment**
1	Project Module
2	Assignments on Test Cases.
3	Assignments on Test Plan and Test Strategies
4	Assignments of Test Methodologies
5	Assignments on Manual Testing.
6	Assignments on Automation Testing using Selenium.

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36209	**Subject Name: Cloud Computing**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:
- .To study cloud computing concepts, technologies, architecture and applications.
- To understand issues in application deployment and implementations in cloud environment.
- To learn recent trends in cloud computing.

Course Outcomes:

On completion of the course, student will be able to–
- Explain the core issues in cloud computing such as security, privacy, and interoperability.
- Choose the appropriate technologies, algorithms, and approaches for the given application.
- Compare and contrast various cloud services

Course Contents	
Unit I Introduction to Cloud Computing	**03 Hrs**
Overview, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service	
Unit II Abstraction and Virtualization	**06 Hrs**
Using Virtualization Technology, Load Balancing and Virtualization – The Google Cloud, Understating Hypervisors – Virtual Machine types, Exploring SaaS – salesforce.com, Exploring PaaS- force.com, Exploring IaaS – Amazon EC2	
Unit III Programming Environment	**06 Hrs**
Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS, Microsoft Azure, Emerging Cloud Software Environments.	

Unit IV Deploying Applications and cloud services	05 Hrs
Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications	
Unit V Emerging trends in cloud computing	**05 Hrs**
Multi-Cloud Vs Omni-Cloud, Integrated Blockchain technology, Kubernetes, Cloud AI, Intelligent SaaS, Kubernetes Supremacy, Containerization by Industry Giants	
Unit IV Security In The Cloud	**05 Hrs**
Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management – Security Monitoring, Security Architecture Design	
Reference Books: 1) Cloud Computing: Principles and Paradigms, Editors, RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Wiley,2011. 2) Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010. 3) Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010. 4) Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India,2010. 5) Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, Brian J. S. Chee and Curtis Franklin. 5) AWS, The ultimate guide from beginners to advanced, Maveric Koston. 6) Microsoft Azure: Planning, Deploying, and Managing Your Data Center in the Cloud, Anthony Puca, Mike Manning, Marshal Copeland, Julian Soh, David Gollob.	

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36211	**Subject Name: Cloud Computing Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:
- . To study cloud computing concepts, technologies, architecture and applications.
- To understand issues in application deployment and implementations in cloud
- environment. ·
- To learn recent trends in cloud computing.

Course Outcomes:
On completion of the course, student will be able to–
- Explain the core issues in cloud computing such as security, privacy, and interoperability.
- Choose the appropriate technologies, algorithms, and approaches for the given
- application.
- Compare and contrast various cloud services.

	Lab Course Contents
Sr. No	**Assignment**
1	Launching EC2 Instance(windows)- AWS Platform
2	Launching EC2 Instance (Linux)- AWS Platform
3	Create an EC2 Linux Instance and Install an Apache Web Server and run hello World page (Use AWS Platform)
4	Practical Implementation of Storage as a Service Create an S3 Bucket, Upload a file to S3 Bucket, Retrieve a File from S3 Bucket, and Delete a File from S3 Bucket using AWS.
5	Implementation of Storage as a Service Hosting a static website in AWS using S3
6	Working and Implementation of identity management
7	Using EC2 Service install Red-hat Linux instance and install python and run python program.

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36212	**Subject Name: Machine Learning**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Theory: 02 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:
- Introduce fundamental concepts of machine learning and its applications.
- Understand various types of learning and model evaluation techniques.
- Explore popular machine learning algorithms and their real-world applications.

Course Outcomes:
- Understand fundamental concepts, methods, and applications of machine learning.
- Apply machine learning techniques to solve real-world problems.
- **Evaluate** models and **analyze** their performance.
- Understand ethical considerations and challenges in implementing machine learning systems.

Course Contents	
Unit 1: Introduction to Machine Learning	**06 Hrs**
Definition, Importance, and Applications of Machine Learning, Types of Machine Learning: Supervised, Unsupervised, Semi-supervised, Reinforcement Learning, Basic Terminologies: Dataset, Features, Labels, Training, Testing, Steps in the Machine Learning Pipeline	
Unit II: Supervised Learning	**08 Hrs**
Regression: Linear Regression, Logistic Regression, Classification: Decision Trees, Support Vector Machines (SVM), Overfitting and Underfitting, Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, ROC Curve	
Unit III: Unsupervised Learning	**06 Hrs**
Clustering: K-Means, Hierarchical Clustering, Dimensionality Reduction: Principal Component Analysis (PCA), Applications of Unsupervised Learning	
Unit IV : Reinforcement Learning	**05 Hrs**
Concepts of Agents, Environment, Rewards, and Policy, Q-Learning and Deep Q-Learning Basics, Real-World Applications	
Unit V : Tools and Applications	**05 Hrs**
Introduction to Machine Learning Libraries: scikit-learn, TensorFlow, PyTorch, Case Studies: Spam Filtering, Recommendation Systems, Image Recognition, Ethical Considerations and Challenges in Machine Learning	
Reference Books:	
1. Introduction to Machine Learning by Abhishek Gupta	
2. Machine Learning: Fundamentals and Applications by P. Ranjan and B. Joshi	

3. Machine Learning"by Saikat Dutt, Subramanian Chandramouli, and Amit Kumar Das

4. Machine Learning and Big Databy Rajiv Chopra

5. Data Mining and Machine Learning by V. K. Jain

6. Machine Learning" by Tom M. Mitchell

7. Pattern Recognition and Machine Learning" by Christopher M. Bishop

8. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

T.Y. B.C.A. SEMESTER VI	
Subject Code: BCA36213	**Subject Name: Machine Learning Laboratory**
Credits: 02	**Continuous Internal Assessment: 20 Marks**
Practical: 04 Hrs./Week	**College Semester Examination: 30 Marks**

Course Objectives:
- Introduce fundamental concepts of machine learning Tools.
- Understand various types of learning and model evaluation techniques using different tools and techniques.
- Explore popular machine learning algorithms and their real-world applications using case study.

Course Outcomes:
- Understand fundamental machine learning Tools.
- Apply machine learning techniques to solve real-world problems.
- **Evaluate** models and **analyze** their performance.
- Understand learning types with case study.

Lab Course Contents	
Sr. No	**Assignment**
1	Getting Started with Machine Learning Tools
2	Data Preprocessing
3	Supervised Learning - Regression , Classification
4	Unsupervised Learning -Clustering Techniques, Dimensionality Reduction
5	Reinforcement Learning
6	Case Study and Model Deployment